



# WATER ECOSYSTEM

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OULUN YLIOPISTO AIF Water Ecosystem





## 1. The purpose of Water ecosystem

Water Ecosystem is co-operative community of ICT- and water industry companies, municipal waterworks, industries operating water processes, mines, research and environmental authorities.

We start by identifying the technology needs of our partners. Working together to solve the problems, testing the solutions in our testing platform and finding the opportunities on the domestic and international markets.

Water Ecosystem is also a place to introduce industry partners to each other and share their contact details.

## 2. Allied ICT Finland (AIF)

Allied ICT Finland (AIF) is a collaboration network of 11 research institutes, 5 cities, 10 business ecosystems, thousands of researchers and more than 1200 companies.

Digitalization creates vast possibilities for growth, but new ways of agility, investments and partnership models are needed in order to succeed. Finland must be in the vanguard of new technologies and business opportunities. Allied ICT Finland offers a new model of action and investment, which aims to create a billion euro R&D leap.

AIF ecosystems provide a unified interface to market leads, partnership, top knowledge and sales. Evolved from AIF projects, ecosystems form a concentrated pool of smart specialization, high technology assets and the latest knowledge for companies to co-operate and develop with each other and the other key players of the industry. The main goal of AIF ecosystems is to enable business growth and internationalization for Nordic companies.

AIF ecosystems: Analytics+, Arctic Drone Lab, AVR Ecosystem, CyberSec, Hilla Gaming Ecosystem, PrintoCent, SMACC, SuperIoT, Water Ecosystem, 5GTN

## 3. Water Ecosystem

Water scarcity, urbanization, changing demographics and operational efficiency are top issues for the global water industry sector. The impact of climate change amplifies the need to tackle these challenges.

## Allied ICT Finland Water Ecosystem White paper

This situation poses a growing need to develop more efficient, environmental friendly and high quality for the operation and maintenance of industrial and municipal water processes. These requirements can only be met by integrating latest high-end technologies and innovations into new products and services.

The Water Ecosystem generates new high-end solutions to tackle these challenges. This is achieved by combining leading edge expertise and innovations from research fields, technologies, product development and commercialization.

The main driver for Water Ecosystem activities is the customer and customer requirements. The customers are the owners of the water processes in both industrial and water supply sectors. The aim is to initiate actions that create new services and solutions to the markets and create added value for the customers.

### 3.1. How we operate

The water ecosystem has three focus areas where it is actively operating aiming to create customer driven new solutions

- Municipal waterworks – drinking water, wastewater, water networks
- Industry - Pulp and paper industry, Metal surface industries, Chemical industries, Food industries
- Mining industry – water processes very close to the nature

Water ecosystem will facilitate workshops in the streams to kick-off solving the existing water challenges.

The target to organize workshops around current topics is

- a. To share recent innovations and progress in different research fields, technologies, product development and commercialization, but also
- b. To enhance the understanding of customer requirements, business opportunities and challenges in the water and wastewater treatment processes
- c. To accelerate and promote networking between different stakeholders to e.g. to find business and research partners.

### 3.2. The role of Water Ecosystem

The Water Ecosystem will

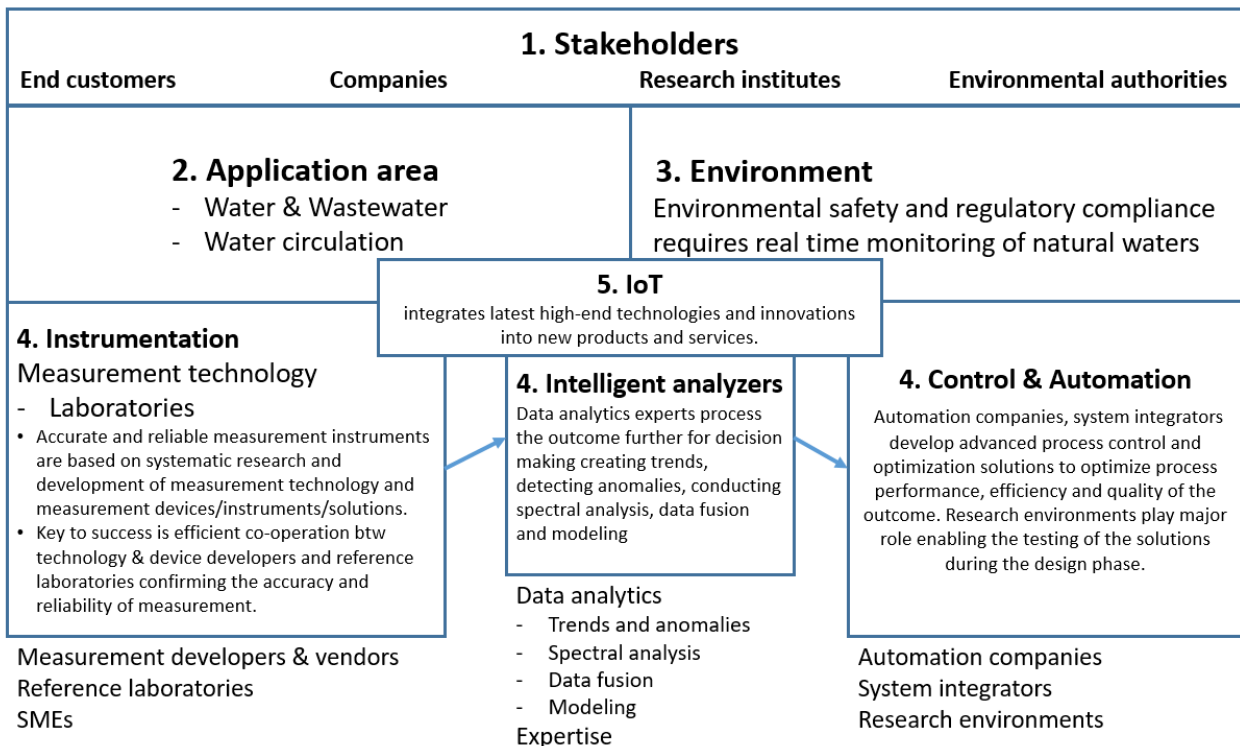
- Act as neutral layer between end customers, measurement developers and vendors, automation companies, system integrators and environmental authorities
- Increase the co-operation of the participating companies, building consortiums and acting as a business quarterback; and
- Perform talent scouting and actively promoting research to business co-operation and communication

The Water Ecosystem will offer for companies:

- Latest high-end ICT and automation expertise
- Expertise in critical measurement solutions
- Scalable business ideas and opportunities
- Partnerships & Joint Business Cases
- Expanded market visibility
- Shared R&D Environments

## 4. Innovations to tackle the water challenges

Water Ecosystem strengthens, accelerates and solidifies the co-operation between end users, companies, research institutes and environmental authorities. The outcome is successful, market demand driven end-to-end solutions for international markets. This is achieved by combining the expertise and innovations from different research fields, technologies, product development and commercialization. The scope covers water, wastewater, water use & circulation and natural water systems related activities.



In the picture:

1. Stakeholders - Members of Water Ecosystem: End customers, Companies, Research institutes, Environmental authorities
2. Application areas – Focus areas: Water, Wastewater, Water circulation
3. Environment - regulations: How to adapt the innovations to environmental safety and regulatory requirements
4. Instrumentation, Intelligent Analyzers, Control & Automation: New solutions to solve water problems
5. IoT: Integration of the latest high-end technologies into new products and services to solve water problems

The primary purpose of instrumentation, control and automation (ICA) in water and wastewater treatment processes is to allow for efficient operation in terms of fulfilling standards while maintaining operational and capital costs as low as possible.

The main driving forces for ICA are most often related to:

- stricter water quality standards
- economic incentives

- reduce energy consumption and/or increase energy production
- increased plant complexity (co-ordination of processes and loops, monitoring etc.)
- new treatment concepts – e.g. more compact plants, water reuse
- new and cheaper technical solutions – e.g. computers, communications

## 5. Global Outlook of the Water Industry, 2018 - Sustainable Water Solutions Through Digitalization

(Source: Global Energy & Environment Research Team at Frost & Sullivan, May 2018)

### 5.1. Municipal Water and Wastewater

#### 5.1.1. Key 2018 Municipal Water Market Predictions

There is a spurt in investments in smart water grids. A total of 1000 cities across the globe have wide-ranging smart city projects ongoing. Sustainability and resilience are the key focus areas of development. Smart metering, asset management, and energy-efficient treatment technologies are in most demand from utilities across the globe.

1. Smart water grids leveraging on IOT and digitalization  
A smart water grid is a key infrastructure component in a smart city. IoT is being implemented across the grid for real-time visualization. Cloud and big data platforms are used to collect and analyze data.
2. LPWAN – NB IoT based smart water metering  
Advanced Metering Infrastructure (AMI) – Smart water metering enabled with IoT is witnessing a rapid growth. Cellular LPWAN communication NB-IoT is being explored for its efficiency and M2M capability.
3. AI and Robotics solutions explored for management and repair  
Artificial intelligence (AI) is being explored in membrane-based treatment systems for complete automation of operations. Robotics is being explored for maintenance and repair of assets.
4. Prepaid payment model adopted in Africa, South America and Asia  
Prepaid smart water meters are being installed in the developing economies of Africa, Asia, and South America. This payment model guarantees monetization of water services.
5. Sludge as a resource  
Europe is leading the development of projects that use sludge as a source of energy. Some Asian and African countries are using sludge as manure. Europe is currently developing policies to promote sustainable use of sludge.
6. Smart dosing and odor control  
Advanced utilities are striving for automation and are implementing smart dosing and odor control systems that automatically calculates the dosing requirements and also controls odor.

### 5.1.2. Key Global Municipal Water and Wastewater Markets

The demand for IoT-enabled smart process control management is growing rapidly among utilities.

Process control and management equipment are experiencing a significant growth rate with the surge in demand for IoT-enabled smart equipment among utilities. Investments in smart equipment have shown to increase efficiency and decrease OPEX. Operation & maintenance continues to be the segment that accounts for the maximum expenditure. Water treatment chemical manufacturers are currently exploring multi-specialty chemicals used in cleaning membranes, and there is a gradual shift in demand for disinfection chemicals as alternates to chlorine. Design software and VR are gradually transforming the design, engineering & construction sector with real-time visualization.

#### 5.1.2.1. Europe

Europe is the leading destination for the implementation of innovative circular economy projects envisaging the sustainable use of sludge and nutrient removal.

More than 6000 water treatment plants are expected to be built or renovated in the next five years across the EU.

Adoption of advanced treatment technologies and innovative circular economy models has led to the implementation of projects such as energy-positive wastewater treatment. Further, the use of sludge as a resource for energy generation and as bio fertilizers has presented new opportunities.

Water utilities are aggressively pursuing the implementation of smart water metering projects to reduce Non Revenue Water (NRW) and detect leaks. Asset management tools and data analytics platforms with a key focus on predictive analysis are rapidly growing opportunities.

#### 5.1.2.1. Middle East & Africa

In order to balance between water availability and demand, technologies like reverse osmosis to experience tremendous growth.

Gulf Cooperation Council (GCC) countries are implementing plans to double desalination capacity by 2030 to meet soaring demand. Kingdom of Saudi Arabia is set to privatise its water infrastructure to bridge demand and increase efficiency. Water scarcity and stress has caused African utilities to invest in sustainable water infrastructure.

**Saudi Arabia's** Vision 2030 comprises an urban infrastructure project of a massive scale. It includes the establishment of new desalination projects, smart water grids, and reuse facilities. The delivery plan 2020, which is a part of Vision 2039 aims to privatize Saline water conversion corporation (SWCC) and Ras Al kahil power and water plant. It is expected to save the Saudi government \$33 billion in CAPEX and OPEX.

**The United Arab Emirates, Qatar and Kuwait** are continually increasing their desalination capacity and upgrading existing networks in line with their expanding urban development projects.

**Egypt** is set to build 4 desalination projects by 2022 in the Sinai region as a part of the \$15.6 billion Sinai development plan with funding from Kuwait.

**Africa** is witnessing a spike in funding and investments into developing its water infrastructure spurred by water scarcity and the need to plug the water and sanitation gap. Water treatment and the supporting conveyance infrastructure are the key projects. Mass rollout of prepaid and smart metering projects by utilities is expected.

#### 5.1.2.1. North America

Increasing stress on water resources is driving the demand for a resilient water infrastructure.

There is a growing demand for sustainable and resilient water infrastructure enabled by IoT-based smart components. Severe water stress has fast tracked water reclamation and reuse projects in states hit by drought and scarcity. Increased environmental awareness has led to growing demand for sustainable and resilient water and wastewater infrastructure. Water utilities are expanding their wet weather management capabilities through advanced treatment systems as water pollution due to storm water runoff has become a concern among the public.

**The US and Canada** are the leading destinations for Advanced Metering Infrastructure (AMI) based smart water metering projects. Asset management tools and smart water metering have become a key priority as new policies have increased the accountability of utilities in regards to water conservation and quality.

**California** has made it mandatory for utilities to report water loss. The stipulation has spurred the implementation of smart water metering and Non Revenue Water (NRW) as well as leak detection solutions.

#### 5.1.2.2. Latin America

Due to financial constraints, major wastewater projects in Latin America have been experiencing significant delays. Stressed availability of water and resurging economic conditions are in Brazil, Argentina, Columbia and Mexico.

**Brazil:** Lack of funding, slow project implementation, and economic downturn have caused huge delays.

**Argentina** recently unveiled a \$21.6 billion plan, set to complete by 2022, to build water infrastructure that includes setting up of new water treatment and supply facilities along with upgrade of existing units.

**Chile** is currently investing in water reclamation projects.

**Mexico** is set to be a major destination for water and wastewater infrastructure development in 2018. The country is focusing on improving sanitation through investment in centralized wastewater infrastructure in urban regions. It is also set to invest in three large desalination plants.

### 5.1.2.3. Asia-Pacific

Water security has become a key focus in efforts to achieve sustainable socio-economic development. Steady economic growth in APAC is expected to help sustain the growth momentum. India's smart city projects, China's massive investments into river clean-up projects and expanding the smart water network, and the addition of new water infrastructure in ASEAN countries to meet demand are sustaining growth.

In **India** Smart city projects are being implemented focusing mainly on pan-city network coverage, smart metering, improved water quality, and remote-automated control & monitoring for efficiency. There is also renewed focus on the reuse of treated water and improved sanitation services.

**China's** 13th 5-year plan specifies the need to tackle water pollution. China plans a large-scale clean up through extensive sewerage networks and advanced treatment technology coupled with smart monitoring devices for automation and efficiency. The country plans to achieve 95% treatment coverage in cities by 2020. It has also opened doors for foreign investments into its water utilities and infrastructure, which gives access to approximately \$400 billion worth of projects in the next 5-10 years.

**Australia, Japan and Korea** are exploring the development of smart water grids along with the implementation of water reclamation projects, which envisage the use of treated wastewater as an alternative source to meet soaring water demands. Advanced Metering Infrastructure (AMI), water data services, real-time visualization, tertiary treatment, and desalination offer key opportunities.

**Malaysia, Indonesia, Vietnam and Cambodia** are sustaining their efforts to bridge the water and sanitation demand gap. Improved provision of urban water services are the key priority of major cities in this region, Key projects include capacity addition and expansion of water and wastewater treatment plants along with extension of water networks.

### 5.1.3. Key Global Municipal Water and Wastewater Technology Trends 2018

Asset sustainability and operational efficiency are set to be improved through smart – IoT components and data analytics platforms.

1. Regulatory policies focused on conservation and sustainability have led to water utilities embracing smart process control and management systems and IoT-based communication technology and data analytics platform for improved efficiencies, apart from advanced treatment technologies. The process control and management segment is set to grow at a rate of 9.6%.
2. Membrane-based treatment technologies continue to dominate the market due to shifting policies, which recognize desalinated water and reclaimed water as climate-proof and reliable alternative to conventional resources.
3. Smart water metering is gradually being adopted for reduction of leaks and Non Revenue Water (NRW). Additionally, smart meters are the source of value-added data to optimize resource, predict consumption patterns, and provide qualitative analysis and real-time visualization. The smart water grid is expected to grow at a rate of 33%, with North America, Europe and China being the leading destinations.
4. Energy efficiency in treatment systems has become a focal point of innovation in treatment technologies. Energy-positive systems are set to become a key requirement with advancement in the use of sludge as a resource and in connecting treatment plants to renewable energy sources.



5. A growing trend of innovative business models like Pay-for-Performance and Hybrid Annuity PPP models are being explored and adopted by cash-strapped utilities. This helps in promoting innovation and increasing efficiency.

## 5.2. Industrial Water and Wastewater

### 5.2.1. Key 2018 Industrial Water Market Predictions

Increased environmental awareness and liability, coupled with stringent regulatory policies, are positively influencing industries to adopt advanced water treatment technologies.

1. IoT and Artificial intelligence (AI) are being explored for fully automated treatment systems  
Industrial IoT and AI are being implemented to integrate the industrial treatment process with the centralized mainstream process control, which ensures efficiency and a reduction in OPEX.
2. Smart sensors with self-calibrating and self-cleaning capability  
Smart sensors are being developed and implemented with self-cleaning and self-calibration capabilities which ensure quality data, leading to efficiency improvements in the entire treatment process.
3. Mobile and decentralized treatment systems  
The demand for mobile – decentralized treatment systems is growing due to its small footprint and quick installation. Oil & gas and power generation industries are the major customers.
4. Water/ Treatment as a Service business model  
Water as a Service (WaaS) model has helped to shift the burden of performance from the customer to the service provider. This model is being pursued by industries like food & beverage and power generation.
5. Expansion of refining capacity in APAC  
The demand for water treatment systems from petrochemical industries is set to grow at a rate of 8.5%. This is mainly due to expansion of refining capacity in countries like India and China.
6. Water-efficient technologies to meet reuse/Zero Liquid Discharge (ZLD) demand  
Water efficiency has become a key criteria for the treatment of industrial wastewater. Water stress across the globe has driven policies favoring water reclamation efficiency and zero liquid discharge.

### 5.2.2. Key Global Municipal Water and Wastewater Markets

Data analytics and cloud computing platforms have boosted the growth of IoT-enabled smart control and management equipment.

The operation & maintenance segment continues to account for a majority of the market expenditure. The innovative business model is mostly shifting the performance burden on the solutions or the technology provider, thereby creating a greater push for the development and implementation of efficient and

sustainable technologies. The process control & management segment has garnered key attention due to the implementation of analytics platform, cloud computing, and IoT-enabled smart equipment and sensors. Industries are pursuing the use of multi-specialty chemicals and are also keen on reducing chemical consumption with a gradual shift toward chemical-efficient technology.

#### 5.2.2.1. Europe

Investments, policy push towards circular economy, and discharge regulations are the key factors behind the expected positive market growth in Europe.

Stringent enforcements and 'polluter pays' policy adopted by most countries have made Europe a leading destination for advanced water treatment systems. Ceramic membrane and poly cera membrane is set to disrupt industrial membrane based treatment systems.

Stable growth of pharma, food & beverage, and chemical industries presents wider opportunities for the adoption of advanced treatments systems, with regulations requiring the removal of nutrients before discharge.

#### 5.2.2.2. Middle East & Africa

Captive desalination plants dedicated to industrial needs are being adopted. Industrial diversification investments and plans by **GCC countries** have led to a rise in demand for desalinated water and recycling of water.

Energy efficiency has become a key criteria for all membrane-based treatment systems. Treatment plants are now being linked to solar energy sources. Additionally, energy production from sludge is also being explored. Self-cleaning membranes and AI operated treatments systems are set to disrupt the market.

In Africa water scarcity has pushed countries to implement sustainable treatment systems. Mining and petrochemical industries are the leading customers in the African region.

#### 5.2.2.3. North America

Growing oil & gas industry and a robust manufacturing growth will contribute to the growth of the industrial water market in North America.

Shale gas exploration and production, resurging growth in the manufacturing sector, coupled with water scarcity in some regions, have led to rising demand for advanced recycling technology.

Decentralized as well as mobile water treatment systems are increasingly being adopted by industries for their efficiency, cost effectiveness, and attractive business models such as Pay-for-Performance and agreements to sell water and energy.

There has been a renewed focus on smart process control and management via IOT-enabled monitoring devices and quality sensors.

#### 5.2.2.4. Latin America

Slow but steady revival of the Latin America economy is expected to boost growth.

**Brazil and Mexico** are coming under increasing pressure to adopt sustainable treatment systems to mitigate environmental degradation and water stress during times of drought. The countries have initiated projects and implemented policies at a regional level favoring the use of reclaimed treated domestic wastewater by industries.

In **Chile** the mining industry is increasingly adopting desalination to meet the rising water demand. Environmental degradation and water stress are the key drivers.

#### 5.2.2.5. Asia-Pacific

Huge investments in industrial corridors, increased environmental awareness to protect water bodies, and water stress is driving growth in the region.

**China** has recently cracked down on independent refineries for flouting environmental regulations. This move is expected to increase the demand for efficient treatment systems.

**India** plans to double its refining capacity in the next 5-10 years, giving rise to huge opportunities for water treatment systems given the strict discharge regulations set for refineries.

**China and India** have embarked on large-scale clean up of water bodies that has led to stricter implementation of discharge regulations. Despite concerns over feasibility and cost of the ZLD system, the two countries are pushing heavily polluting industries such as chemical, textile and tanneries to implement ZLD.

In **Malaysia, Indonesia and Vietnam** growth of microelectronics and food & beverage industries has led to increased adoption of membrane-based treatment systems and decentralized wastewater treatment systems.

#### 5.2.3. Key Global Municipal Water and Wastewater Technology Trends 2018

There is a rising demand for IoT-enabled equipment and analytics platforms for ensuring sustainable asset and performance management.

1. Smart sensor-based process control and management, with the added feature of data analytics platform, will experience the highest growth among segments, at 9.3%.
2. Water and energy conservation has become a primary concern among industries across the globe due to policies favoring and promoting the sustainable use of resources. Membrane-based technology is highly pursued for its efficiency and reliability.
3. Reduced fouling, longevity, and reduced OPEX of ceramic membranes have led to large-scale installations of ceramic membrane treatment systems, especially in the highly corrosive environments in Europe and Middle East.

Allied ICT Finland Water Ecosystem  
White paper

4. Performance-based business models coupled with incentives for water conservation and energy generation have led to investments in AI-based operation and management software that helps to improve efficiency of the treatment process.
5. The growth in refineries and oil & gas industries is set to lead the demand for industrial water & wastewater treatment services with a growth rate of 8.6%.

### 5.3. Growth Opportunity — Smart Capabilities

Summary of the growth opportunities with smart capabilities:

- AI, cloud computing, and big data are increasingly being adopted by the water industry.
- IoT-fitted equipment, enabled by latest communication technology such as LPWAN, is gaining significant attention especially in process control & management among industries and smart metering among municipal end users.
- IntelliFlux Controls, an AI software, has been implemented to fully automate the operation and management of a membrane-based treatment system on a pilot basis by Water Planet Inc.
- Leading meter manufacturers like Diehl and Kamstrup have implemented LPWAN based smart metering. IBM, CISCO, and Microsoft are implementing cloud computing and big data platforms/solutions for asset management and efficient process control.

Summary of the growth opportunities with smart solutions:

- IoT-compatible treatment systems are set to see high demand in the next five years.
- LPWAN based communication technologies allow for easier adoption of IoT due to its range and efficiency.
- Collaboration with IoT – communication modules / solution providers and cloud computing , AI or big data solution providers will provide added value.
- AI software has proven to boost water and energy efficiency of treatment systems. This could drastically reduce OPEX.

## 6. INDUSTRY PARTNERS

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Allwatec provides services for pipeline cleaning, proof testing, disinfection, locating pipes, pipe leaks and pressure pipes.

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Aquaminerals produces adsorbent products based on natural minerals for efficient elimination of harmful metal ions and humus from water. The products can be matrix. In addition to adsorbent products, we supply appropriate dosing equipment for them.

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Aquator Oy operates in the field of process filtration and water treatment. Company provides answers for the industrial process problems related to the water or fluid quality.

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Buildie is a documentation application for water supply construction and renovation that is used by dozens of water plants in Finland. Buildie enables better work quality control and real-time communication on site. Through its own activities, Buildie strives to develop the industry's documentation practices and to improve the quality of construction in Finland.

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We offer a decentralized water purification solution for the absorption, arrest and cleaning of low-nutrient waters. The overflow can be guided by the Carbons Plus Biochar product and the colonized growth medium. Biochar absorbs and retains the lappiness of its own volume. Biochar + wood pellets can be used to control drainage and drainage water. Carbons Finland Oy has a patented filter solution. There are various solutions, from small filters to large ones.

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Cloud Asset is a Cloud Computing and Big Data technology startup whose mission is to help customers adopt cloud capabilities at the heart of their operational strategy through a set of vertical industry use-case specific solution stacks. Cloud Asset's project portfolio includes utilization and development of IoT, Big Data, analytics, visualisation, streaming, and storage technologies and solutions in financial, cleantech, security, environment, and healthcare sectors.

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Creoir designs and develops wireless devices such as smartphones, smart speakers, wearables and IoT solutions to our clients globally. We offer product development services including industrial design, hardware and software development, manufacturing, after sales and cloud services.

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Digita Oy digitizes the water sector by providing water supply companies with the various solutions listed below:

- Remote water clearing
- Surface measurements (droppings, groundwater, tanks, waterways, water pools, etc.)
- Detection of leaks
- Storm water, drains, sewage
- Levels of wells & tanks
- Groundwater level, water level

Digita uses LoRaWAN as an IoT technology.  
Digita is a member of LoRa Alliance.

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EHP Environment EnMonCon – environmental monitoring concept.  
We redesign our customers' monitoring program based on reliable online measurements in critical monitoring points, which reduces the need for manual sampling in total. This way our concept offers significant savings in total monitoring costs, when compared to a heavy traditional monitoring program based on manual sampling.

Information status of the environment allows know exactly environmental load, optimize processes and with the help of our early-warning system, to prevent serious environmental accidents from happening. In EnMonCon, environmental data from different sources are directed to a central data management system where it can be easily analyzed it. Map-based views, automatically updated graphs and tailored reports are available.

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Filterit is a company specializing in industrial and municipal filtration solutions, UV disinfection and water treatment. Our long-term experience and know-how create the foundation for secure solutions. Our solutions are the leading manufacturers in the industry.

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Fluidit is a mixture of water engineering professionals and top-class software developers. We are experienced in smart water solutions focusing on water distribution and wastewater collection systems. We have developed our own hydraulic modeling software and it is available to utilities, consultants and universities. We also provide consulting services for general network planning and analysis as well as high expertise solutions.

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Grundfos is one of the world's leading pump manufacturers, producing about 16-million units a year. Its main production lines are pumps for heating and air conditioning and centrifugal pumps for Grundfos supplies a full line of equipment and solutions designed specifically for water utility applications. Grundfos is at the forefront in promoting and facilitating energy efficiency and sustainable technology, ensuring that water supply and wastewater facilities meet future challenges and regulations.

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Kemira offers wide range of chemicals and chemical based solutions to water treatment. Main chemicals are iron and aluminium salts and polymers, but we offer also pH adjustment chemicals, biocides, defoamers and antiscalants to water treatment applications. Kemira has also recently launched digital Kemconnect® applications that can be utilized in chemical storing, sludge dewatering and phosphorus removal.

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Keypro supports network owners to manage and document their investment in water-, heat-, electric-, light-, gas and telecom networks.

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KL-Lämpö Oy specializes in water treatment products and services, which boost energy efficiency. Our solutions help optimize the quality, efficiency and reliability of water treatment processes in industrial, municipal and energy plants as well as building maintenance services.

The main purpose of our water treatment services is to control corrosion levels and to prevent scale and deposits. Our operations are based on high-quality water analyses and research activities conducted in our own laboratory.

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LED Tailor Innova7ion's founders have over 10 years of experience in designing and manufacturing LED light technology and UV LED technology products. The reliability and performance of our products are based on the highest quality components and special-purpose optical materials.

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Outotec provides leading technologies and services for the sustainable use of Earth's natural resources. As the global leader in minerals and metals processing technology, we have developed many breakthrough technologies over the decades for our customers in metals and mining industry. We also provide innovative solutions for industrial water treatment, the utilization of alternative energy sources and the chemical industry. Outotec shares are listed on NASDAQ Helsinki.

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Allied ICT Finland Water Ecosystem  
White paper

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Owatec Group Oy is a water and environmental company that provides solutions for water and waste treatment. In addition to processing technology, Owatec projects for companies, industry and service companies.

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SATEL radio modems are used widely for the remote control and monitoring of waterworks and sewage processing plants. Since these installations are often in remote places or cover a large area, the data network needs to be flexible, easy to extend and above all reliable.

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## 7. RESEARCH PARTNERS



## 8. BUSINESS DEVELOPMENT PARTNERS

